Chapter 7

Date/Time Format

PDS has adopted a subset of the International Standards Organization Standard (ISO/DIS) 8601 standard entitled “Data Element and Interchange Formats - Representations of Dates and Times”, and applies the standard across all disciplines in order to give the system generality. See also Dates and Times in *Object Description Language* (Chapter 12, Section 12.3.2) of this document.

It is important to note that the ISO/DIS 8601 standard covers only ASCII representations of dates and times.

7.1 Date/Times

In the PDS there are two date/time formats recognized as legal:

CCYY-MM-DDTHH:MM:SS.sssZ (preferred format)
CCYY-DDDTHH:MM:SS.sssZ

Each format represents a concatenation of the conventional date and time expressions with the two parts separated by the letter T:

CC	-	century (00-99)
YY	-	year (00-99)
MM	-	month (01-12)
DD	-	day of month (01-31)
DDD	-	day of year (001-366)
T	-	date/time separator
HH	-	hour (00-23)
MM	-	minute (00-59)
SS	-	second (00-59)
sss	-	fractions of second (000-999)

The time part of the expression represents time in Universal Time Coordinated (UTC), hence the Z at the end of the expression (see Section 7.3.1 for further discussion). Note that in both the PDS Data Set Catalog and data product labels the “Z” is optional and is assumed.

The preferred date/time format both for labels and Data Set Catalog templates is CCYY-MM-DDTHH:MM:SS.sssZ.

Date/Time Precision

The above date/time formats can be truncated to match the precision of the date/time value. The following are examples of date/time values having limited precision:

1998
1998-12
1998-12-01
1998-12-01T23
1998-12-01T23:59
1998-12-01T23:59:58
1998-12-01T23:59:58.1

ODL Date/Time Information

Chapter 12, Object Description Language (ODL) Specification and Usage, section 12.3.2, Dates and Times, of this document provides additional information on the use of ODL in date/time formation, representation, and implementation.

7.2 Dates

The PDS allows dates to be expressed in conventional and native (alternate) formats.

7.2.1 Conventional Dates

Conventional dates shall be represented as either year, month, and day-of-month or as year and day-of-year using the full ISO/DIS 8601 format, which has the fields separated by dash characters, as follows: CCYY-MM-DD or CCYY-DDD. Both formats are acceptable for use in PDS labels and Data Set Catalog templates, but the PDS recommends the CCYY-MM-DD convention.

7.2.2 Native Dates

The format of a native date is user specified. An example of a native date is Julian Day, an integer count of days since a given reference day (January 1, 4713 B.C.)

7.3 Times

The PDS allows times to be expressed in conventional and native (alternate) formats.

7.3.1 Conventional Times

Conventional times shall be represented as hours, minutes, and seconds using the full ISO/DIS 8601 format. The hours, minutes, and seconds consist of three two-digit fields separated by

colons, with the field values being modulo 24, 60, and 60, respectively. The seconds field may be optionally followed by a fractional part; if fractions of seconds are specified, a period shall be used as the decimal point and not the European-style comma. The fractional part shall be at most 3 digits long.
The PDS has adopted the use of Universal Time Coordinated (UTC) for expressing time, using the format HH:MM:SS.sssZ. Note that in both the PDS Data Set Catalog and data product labels the "Z" is optional and is assumed. Fractions of seconds cannot exceed a precision of milliseconds.

The START_TIME and STOP_TIME data elements required in data product labels and catalog templates use the UTC format. For data collected by spacecraft-mounted instruments, the date/ time shall be a time which corresponds to "spacecraft event time". For data collected by instruments not located on a spacecraft, this time shall be an earth-based event time value.

Adoption of UTC (rather than spacecraft-clock-count, for example) as the standard facilitates comparison of data from a particular spacecraft or ground-based facility with data from other sources.

7.3.2 Native Times

Native or alternate time formats may be represented in a data product label or Data Product Catalog using the NATIVE_START_TIME and NATIVE_STOP_TIME elements. Native times also can be represented using specific data elements. Such data elements may be proposed by the data supplier and reviewed by the PDS.

The following paragraphs describe typical examples of native time formats.

1. **Spacecraft Clock Count (sclk) -** Spacecraft clock count (sclk) provides a more precise time representation than event time for instrument-generated data sets, and so may be desirable as an additional time field. In a typical instance, a range of spacecraft-clock-count values (i.e., a start-and a stop-value) may be required.

   Spacecraft clock count (SPACECRAFT_CLOCK_START_COUNT and SPACECRAFT_
   CLOCK_STOP_COUNT) shall be represented as a right-justified character string field with a maximum length of thirty characters. This format will accommodate the extra decimal point appearing in these data for certain spacecraft and other special formats, while also supporting the need for simple comparison (e.g., ">" or "<") between clock count values.

2. **Longitude of Sun** - Longitude of Sun ("L sub S") is a derived data value which can be computed, for a given target, from UTC.

3. **Ephemeris Time** - Ephemeris time (ET) is calculated as "TAI + 32.184 sec. + periodic terms". The NAIF S and P kernels have data that are in ET, but the user (via NAIF ephemeris readers which perform data conversion) can obtain the UTC values.

4. **Relative Time** - In addition to event times, certain “relative time” fields will be needed to represent data times or elapsed times. Time-from-closest-approach is an example of such a data element. These times shall be presented in a (D,H,M,S) format as a floating point number, and should include fractional seconds when necessary. The inclusion of “day” in relative times is motivated by the possible multi-day length of some delta times, as could occur, for example, in the case of the several-month Galileo Jupiter orbit.

5. **Local Times** - For a given celestial body, LOCAL_TIME is the hour relative to midnight in units of 1/24th the length of the solar day for the body.

6. **Alternate Time Zones (Relative to UTC)** - When times must be expressed according to an alternate time zone, they shall consist of hours, minutes, seconds, and an offset, in the form HH:MM:SS.sss+n, where n is the number of hours from UTC.